Draft Final

WABUSKA DRAIN WORK PLAN

APRIL 7, 2003

PREPARED FOR:

Atlantic Richfield Company
307 EAST PARK STREET, SUITE 400
ANACONDA, MONTANA 59711

PREPARED BY:

BROWN AND CALDWELL

Carson City, Nevada

Atlantic Richfield Company

307 East Park Street
Suite 400
Anaconda, Montana 59711
Phone: (406) 563-5211
Fax: (406) 563-8269

April 7, 2003

Mr. Arthur G. Gravenstein, P.E.
Staff Engineer
Bureau of Corrective Actions -- Remediation Branch
Nevada Division of Environmental Protection
333 W. Nye Lane
Carson City, Nevada 89701

Subject: Response to Comments on the Draft Wabuska Drain Work Plan, dated April 30, 2002 and Submittal of the Draft Final Wabuska Drain Work Plan

Dear Mr. Gravenstein,

Please find attached the Draft Final Wabuska Drain Work Plan. Atlantic Richfield Company appreciates this opportunity to respond to the comments provided by the regulatory agencies on June 18, 2002 for the Draft Wabuska Drain Work Plan. The following responses are also based on the Yerington Technical Work Group (YTWG) meeting held on July 16, 2002, the subsequent site visit conducted by YTWG members to select monitoring locations, and the results of monitoring conducted in February 2003 by NDEP and Atlantic Richfield (presented in the attached Draft Final Work Plan).

<u>Introductory Comments</u>

Comment no. 1: The regulatory agencies have significant comments on the work plan and we acknowledge that many of these issues may be resolved through the development of the Site Conceptual Model. This plan involves a very short-term activity, being a one-time sampling event, and as such will not adequately determine if constituents from the Yerington Mine are being transported through the Wabuska Drain to the Walker River. A much broader characterization should be completed, presumably following the development of a conceptual site model, which will include the identification of receptors.

Response to Comment no. 1: The Conceptual Site Model (CSM) was submitted on October 10, 2002 and was subsequently approved by the regulatory agencies. The attached Draft Final Work Plan reflects the information presented in the CSM.

Comment no. 2: As part of Atlantic Richfield's Short-term Action requirements (EPA/BLM 7/2001 letter) it is imperative that surface sediments and any available flow are sampled this summer. We recommend that four locations are selected utilizing recommendations provided in the following comments for water quality and surface sediment analyses with additional sampling completed after revision of the workplan. The composite samples analyzed from the surface to six inch depths (from four sample locations) will help us assess current exposure as part of the Short-term Action sampling. A brief memorandum is sufficient to clarify the locations for sampling flow and surface sediments prior to

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SECTION 1.0
INTRODUCTION

Atlantic Richfield Company has prepared this Draft Final Wabuska Drain Work Plan (Work Plan) to conduct field investigations that will support an evaluation of the potential risk to human health and the environment that may result from mine-related surface materials or groundwater that may enter the Wabuska Drain immediately north of the Yerington Mine site. This Work Plan is being conducted under the authority of an Administrative Order issued by the Nevada Division of Environmental Protection – Bureau of Corrective Actions (NDEP) as part of site closure investigations described in the Closure Scope of Work (SOW). As stated in the SOW (Brown and Caldwell, 2002a), a "hydrologic and geochemical assessment of the Drain will be performed at up to four monitoring locations, including flow measurements and the collection of surface water samples and soil/sediment samples for laboratory analysis". Based on discussions within the Yerington Technical Work Group (YTWG), and a subsequent visit by YTWG representatives, eight sampling locations were selected for proposed surface water and soils/sediment monitoring.

The remainder of Section 1.0 of this Work Plan describes the location and hydrologic setting of the Wabuska Drain (Drain), previous sampling and analytical results obtained from AHA (1983), the U.S. Geological Survey (1996), NDEP (1999) and NDEP/Atlantic Richfield in 2003. Section 1.0 also describes data quality objectives (DQOs) for this Work Plan. Section 2.0 presents information about the construction and operational history of the Drain and a description of alignment modifications over time, based on an interpretation of aerial photography and topographic maps. Section 3.0 presents quality assurance and quality control procedures, proposed sampling locations, how measurements of surface flows will be made, and sampling protocols for water quality and soils/sediment analyses per the Draft Final Quality Assurance Project Plan (QAPP; Brown and Caldwell, 2002b). In addition, Section 3.0 of this Work Plan presents a task-specific Job Safety Analysis in the context of a more comprehensive Site Health and Safety Plan (Brown and Caldwell, 2002c). Section 4.0 lists references cited in this Work Plan.

1.1 Location

The Wabuska Drain is an agricultural return-flow drain located in northern Mason Valley, Lyon County, Nevada (Figure 1). The Drain originates immediately north of the Yerington Mine site and is aligned to the north past its intersection with the West Campbell Irrigation Ditch, and through the Paiute Indian Reservation. Further to the north, it crosses Highway 95A approximately one mile south of the town of Wabuska, where it is aligned to the east-northeast to its intersection with the Walker River north of the Mason Valley Wildlife Management Area (Figure 1). The Drain is approximately 13.8 miles (72,580 feet) in length.

1.2 Hydrologic Setting

The principal source of water in the Yerington area of Mason Valley is from the Walker River (Huxel, 1969). The East and West Walker Rivers originate in the Sierra Nevada and merge south of the mine site, from where the Walker River flows northward through the valley to Walker Gap. From Walker Gap, it turns eastward and then southeastward to Weber Reservoir and ultimately to its terminus, Walker Lake. The Walker River is the primary source of natural recharge to the alluvial groundwater flow system that underlies the mine site, given that recharge from precipitation is very low (the annual average precipitation rate in the area is 5.46 inches per year; Huxel, 1969). The Walker River Irrigation District (WRID) was organized in 1919 to allocate and manage agricultural diversions along the river.

Streamflow data on the Walker River in the Mason Valley area have been collected intermittently since 1895, and continuously since 1947 (Huxel, 1969). In general, the greatest volume of runoff in the Walker River basin occurs during the period from March to July, when the winter snowpack in the Sierra Nevada thaws. Exceptions to this pattern occurred during winter flood events that occurred in 1937, 1950, 1955, 1963 and 1997 as a result of warm rain on the mountain snowpack. These winter floods are usually of high intensity and short duration, and do not typically produce the total volume of surface flows from spring snowmelt (Huxel, 1969). The large volume of spring runoff provides irrigation water and storage upstream of Mason Valley for use later in the irrigation season.

The Drain is one of the agricultural return-flow features that comprise a complex network of diversions (e.g., the Campbell Ditch) and irrigation drains used to manage Walker River water for agricultural activities in Mason Valley. Huxel (1969) recognized that return flows to the river in the upper reaches of Mason Valley were re-diverted into downstream canals and ditches. In the Yerington sub-area, Huxel (1969) estimated that approximately 9,700 acres of cropland and pasture were irrigated by an average of 12,200 acre-feet.

The Wabuska Drain operates by collecting return flows from crop irrigation, and by intercepting shallow groundwater. Rising groundwater levels result from natural recharge (seepage from the Walker River or direct precipitation) and/or cultural recharge (seepage from agricultural diversions such as the Campbell Ditch and recharge from irrigated fields). In addition to direct runoff from irrigated fields, runoff from direct precipitation on roads, streets and highways also contribute to flows in the Drain.

The alluvial aquifer that contributes groundwater inflows into the Drain consists of unconsolidated alluvial deposits derived by erosion of the uplifted mountain block of the Singatse Range and alluvial materials deposited by the Walker River. These unconsolidated deposits, collectively called the valley-fill deposits by Huxel (1969), comprise four geologic units: younger alluvium (including the lacustrine deposits of Lake Lahontan), younger fan deposits, older alluvium and older fan deposits. Groundwater conditions in the area of the Wabuska Drain are described in the Draft Final Groundwater Conditions Work Plan (Brown and Caldwell, 2003). Lake Lahontan lacustrine deposits appear to have been removed and reworked by the Walker River as it meandered back and forth across the valley Huxel (1969). Huxel estimated that Pleistocene Lake Lahontan in Mason Valley persisted for a relatively short time and was less than 60 feet deep.

The hydraulic grade of the Wabuska Drain between the Yerington Mine site and the southern margin of the Paiute Indian Reservation (Figure 1) is approximately 0.148 percent over 4.1 miles. The grade increases slightly to about 0.160 percent within its 1.1 mile-length within the reservation. From the northern margin of the reservation to its intersection with the Walker River, the average hydraulic grade was calculated at 0.042 percent.

The Wabuska Drain was designed as a low-gradient (low energy) V-shaped to trapezoidal conveyance. Its channel dimensions become larger in the downgradient direction as the drainage area increases. According to the Walker River Irrigation District (Ken Spooner, WRID; pers. comm., 2002), the Drain requires minimal maintenance, typically involving the clearing of brush (by burning) and routine culvert maintenance.

Portions of the Wabuska Drain have established vegetation, which increases the channel roughness and reduces sediment transport. Some areas along the Drain have been burned to clear vegetation. The dimensions and slope of the Drain were estimated from field observations and available topographic information.

Given the flow characteristics calculated for the low-gradient Wabuska Drain, local movement of suspended solids (less than one millimeter size fraction) may occur, although normal sediment transport will be retarded by channel roughness during typical flow conditions. Therefore, sediment transport resulting from agricultural return flows and passive inflows of groundwater will, in general, be limited. However, greater than average channel flow caused by rainfall and runoff conditions may be expected to transport relatively fine particles in suspension for some distance. The collection of field data, including flow rates and water quality, would provide important pathway information in evaluating these hydrologic conditions.

1.3 Previous Monitoring

March 1983

Applied Hydrology Associates (AHA, 1983) collected surface water samples from the Wabuska Drain in March 1983 for water quality analyses, and measured surface water flow rates and field parameters at five locations. This field investigation was conducted prior to the construction of the pumpback well system in 1985 that was designed to intercept groundwater in the shallow alluvial aquifer that may have been affected by past mining operations and surface mine units. Continued operation of, and improvements to, the pumpback and evaporation system have been effective in improving shallow groundwater quality north of the mine site (AHA, 2002).

AHA measured surface water flows at four locations along the Drain in the area immediately north of the mine (Figure 2), and at one location where it crosses Campbell Road. Flows from the four Drain locations between the mine site and Luzier Lane were measured using a portable cut-throat flume that was placed on the Drain bed parallel to the channel axis. Dirt was placed on either side of the flume in order to direct all channel flow through the flume, and care was taken to ensure that the flume was properly leveled in the channel. Water levels in the flume were recorded and a rating table was used to convert the measurements to discharge in cubic feet per second (cfs).

Recorded flow rates ranged from 0.01 to 0.06 cubic feet per second (cfs; 4.5 to 27 gallons per minute or gpm) at the four locations immediately north of the mine, which progressively increased down-gradient, and 4.9 cfs (2,200 gpm) at the Campbell Road location (AHA, 1983; Appendix II). The portable flume could not be used to measure flows in the Wabuska Drain at Campbell Road because the discharge was too large. Therefore, AHA (1983) estimated discharge at this location by calculating the cross-sectional area and slope of flow through the culvert under Campbell Road and using Manning's equation (a slope of one percent and a coefficient of "n" of 0.024 were used in this calculation).

AHA collected grab samples from the Drain near the mine site because the shallow depth of flow prevented the use of a pump to obtain surface samples for water quality analyses. However, the shallow depth of water allowed for a sample to be collected that represented the total depth of flow. AHA took care to not disturb the bottom sediments when the water was sampled. Grab samples were also taken from the Wabuska Drain at Campbell Road in order to maintain consistency of sampling techniques. The sample was collected at a depth of approximately five inches from the water surface. Field measurements of pH, specific conductance and temperature were obtained for all sample locations during surface water sampling. Sample preservation, filtering, storage and transportation of the surface water samples were described in AHA (1983).

The results of water quality analyses of samples taken from the five Drain locations are shown in Table 1, reproduced from AHA (1983). In general, there was little difference between the concentrations of dissolved, total and total recoverable analyses of the analytes at each of the four sampling locations located immediately north of the mine site. Most constituents showed increases in concentration from Locations 1 to 4, corresponding to the direction of flow. Measured flows at these locations indicated that increased groundwater inflows into the Drain occur along this reach, from Locations 1 to 4, as described above.

AHA recognized that the sulfate concentration was highest at Location 3 in the area where shallow groundwater contamination has been identified. The lowest pH level was noted at Location 2, which suggested that discharge of acidic groundwater likely occurred somewhere between Locations 1 and 2 (AHA, 1983). The concentration of iron increased dramatically at Location 2, also suggesting inflows of impacted groundwater between Locations 1 and 2. Analytical results (Table 1) for surface water sampled from the Wabuska Drain at Campbell Road indicated good quality water (Location 5; AHA, 1983).

1994

The U.S. Geological Survey (USGS; Thodal and Tuttle, 1996) sampled water, bottom sediments and biota from various locations within the Walker River Basin during the period of June through August, 1994. Sample locations are shown in Appendix A. One of the sample locations (no. 11) is from the Wabuska Drain in the area of the Yerington Paiute Indian Reservation. This location is also proximal to monitoring locations 6 and 7 described below for the 2003 monitoring activities conducted by NDEP and Atlantic Richfield. Surface water data and chemical analysis for USGS site no. 11 are provided in Appendix A.

November 1999

NDEP conducted water quality sampling at four locations along the Wabuska Drain on November 15-16, 1999. The sample location map, water sampling records and summary of analytical results are presented in Appendix A. NDEP sample locations are also shown in Figure 2. The southernmost sample, WSW-011, was collected from stagnant water north of the mine site, about 0.1 miles north of Luzier Lane (north side of culvert). The next sample (from south to north) at location WSW-008, was collected from flowing water in the Drain about 1.2 miles north of WSW-011 (about 0.3 miles south of the Drain's intersection with the West Campbell irrigation ditch). The third sample, WSW-009, was collected from flowing water in the Drain at its intersection with Campbell Lane (north side of culvert). The fourth and northernmost sample, WSW-010, was collected from flowing water in the Drain immediately west of its intersection with Highway 95A (near a site monitored by Thodal and Tuttle, 1996).

Analytical results from the Wabuska Drain surface water samples collected by NDEP are presented in Table 2 and in Appendix A. Appendix A also presents field monitoring data (i.e., pH and specific conductance). These data indicate that the sample collected immediately north of the mine site, WSW-011, contained elevated concentrations of several constituents relative to the down-gradient samples (e.g., arsenic, barium, boron, calcium, iron, magnesium, manganese, potassium, selenium, sodium, vanadium and zinc). However, because this sample was collected from stagnant water at this location, these constituents were not transported down-gradient (i.e., non-flowing conditions resulted in no transport of these constituents). The chemical quality of this stagnant water sample may have been affected by evapoconcentration, reducing conditions associated with a natural wetland environment and/or direct runoff from the adjacent agricultural field.

<u>February 2003</u>

NDEP and its sub-contractor, SRK Consulting, and Atlantic Richfield's sub-contractor Brown and Caldwell collected soil and water samples and field measurements at eight locations along the Wabuska Drain on February 19, 2003. The sampling locations are shown on Figure 3 and photographs of sampling locations are provided in Appendix B. Brown and Caldwell collected field measurements and samples from sample locations 1, 2, 3, 4 and 5. NDEP and SRK collected field measurements and samples from locations 6, 7 and 8 without Brown and Caldwell accompaniment, as required by land access restraints.

Soil pH was measured at discrete depths of 0.5, 1.0 and 2.0 feet below ground surface (bgs) at each location within the base of the Wabuska Drain per the Draft Final Quality Assurance Project Plan (QAPP). At each depth, 10 grams of soil was weighed on an electronic scale in a four-ounce clean glass sample jar. Ten mL of distilled water was then measured in a graduated cylinder and added to the jar, and the soil/water solution was shaken vigorously and allowed to set for approximately 30 minutes. A calibrated soil paste pH meter was inserted into the solution and allowed to stabilize, and the pH value was recorded. The meter accuracy was checked for drift after four samples, and again at the end of the last field pH reading. All pH readings were recorded immediately in the field notebook.

Soil pH values were between 7.31 and 8.35 at all sample locations except locations 5 and 6, where the soil became more acidic. At location 5, soil pH was measured at 3.87, 4.43, and 4.08 at 6, 12 24 inches bgs, respectively. At location 6, soil pH was measured at 6.32, 6.30 and 5.93 at 6, 12 and 24 inches bgs, respectively. The results of soil pH values at sample locations along Wabuska Drain are illustrated in Figure 4.

Composite soil samples were collected from zero to six inches below ground surface at each location, with additional discrete subsurface samples collected at 12 inches and 24 inches at locations 1, 3 and 7 in accordance with the Draft Final QAPP. Samples were collected from the bottom of the channel when no water was present in the Drain, and from the bank above the saturated water line when water was flowing in the Drain. At each sample location, soil samples were collected using a single-use disposable scoop.

At each sample location, the sample interval from zero to six inches below ground surface was combined in one-gallon zip-loc plastic bag and mixed completely. The resulting composite solid media sample was placed in an eight-ounce glass jar and sealed with a Teflon-lined lid. Discrete subsurface samples from 12 and 24 inches below ground surface were obtained in the same manner. The jars were immediately labeled and placed into coolers for transport under chain-of-custody to Sierra Environmental Laboratory in Sparks, Nevada, for whole-rock analysis of metals. All sample handling procedures were performed in accordance with the Draft Final QAPP.

Analytical results for the sediment samples collected from the Wabuska Drain are provided in Table 3. Three samples from two locations yielded metal concentrations above background concentrations published by Shacklette and Boerngen (1984) and Rose (1979). At location 1, the reported selenium concentration of 0.6 mg/kg from the sampled zero to six-inch interval was higher than the range of reported background values (0.15 to 0.31 mg/kg). At location 2, the 0.7- mg/kg selenium concentration from the sampled zero to six-inch interval was also higher than the range of reported background values for selenium. Also at location 2, the iron concentration of 38,000 mg/kg from the sampled zero to six-inch interval was higher than the reported background value of 30,000-mg/kg (Shacklette and Boerngen, 1984).

The Wabuska Drain was inspected for the occurrence of flowing water from sample locations 1 through 8. The Drain was observed to be dry from the mine site north to some distance north of location 5. Between locations 5 and 6, water from the East Campbell ditch was allowed to flow into the Wabuska Drain for use by local ranchers. Flow velocities were measured by NDEP and SRK personnel at locations 6 through 8 using a Global Water paddle-type flow meter FP101, which measures velocity with an accuracy of 0.1 feet per second. At the center of the stream, the velocity meter was positioned at approximately 6/10 of the total vertical depth down from the water surface, in accordance with the Draft Final QAPP.

At locations 6 and 7, shallow stream depth allowed measurement of velocity only in the center of the Drain where sufficient depth and flow were present. At location 8, stream flow was too shallow across the width of the Drain to measure with the meter. The flow rates at locations 6 and 7 were calculated from velocity and an estimated cross-sectional channel area (the cross-sectional area was estimated based on measured channel width and observed channel formation). The flows were calculated at 5.8 and 1.4 cubic feet per second (cfs) at locations 6 and 7, respectively. No flow measurement was obtained from location 8.

In addition to flow measurements, NDEP and SRK personnel collected field measurements of pH, conductivity and temperature. At locations 6, 7 and 8, surface water pH ranged from 7.31 to 8.17, conductivity values ranged from 406 to 413 µS/cm, and temperature ranged from 3.4 to 6.6 degrees C. Water samples were collected at locations 6, 7 and 8, in accordance with the Draft Final QAPP. The water samples were collected in flowing water, slightly "upstream" of where the person doing the sampling was standing, to prevent disturbed sediment from contaminating the sample. Water samples were collected from just below the water surface by carefully submerging the mouth of the container two to three inches below the water surface, taking care to avoid sampling where surface debris was present. Single-use latex gloves were used to handle bottles and equipment, and gloves were changed between each sample point. All surface water quality sampling was conducted by NDEP personnel according to the Draft Final QAPP.

Sample labels were completed and attached to each laboratory sample container immediately after each sample was collected, to avoid saturation of the labels during water collection. The labels were filled out with a permanent marker and included sample identification, sample date, sample time, sample preparation and preservative, analyses to be performed, sample type, and the person who collected sample. Both total metals (unfiltered) and, dissolved metals (filtered) samples were each collected in 500-milliliter (mL) bottles. Filtering was conducted inside the Yerington Mine administration building immediately after samples were collected. Single-use, 0.45-µm vacuum filtering cups were used to filter the water samples. Nitric acid was added to the bottles for metals analyses to bring the pH down to less than 2 standard pH units, according to field pH litmus paper. The laboratory also verified the pH when samples were submitted. Non-metals samples were collected in 1,000-mL bottles, unfiltered, with no acid preservation.

The collected water samples were submitted to Sierra Environmental Laboratory for analysis of total and dissolved metals, alkalinity, pH, sulfate, nitrate, turbidity, hardness, total dissolved solids, and total suspended solids. Analytical results are provided in Table 4 for total and dissolved elements and in Table 5 for non-elemental constituents. Analytical results indicate that all constituents meet Nevada Standards (NAC 445.144) for surface water for domestic, aquatic or irrigation beneficial use.

1.4 Data Quality Objectives

The Data Quality Objectives (DQOs) for field sampling and analytical activities described in this Work Plan include the collection of appropriate data to support the:

- Assessment of ecological and human health risk resulting from surface water and sediment in the Wabuska Drain being conveyed to possible down-gradient receptors, and identification of such receptors;
- Assessment of ecological and human health risk resulting from the possible development of metal-bearing soils in or adjacent to the Wabuska Drain (including identified abandoned portions); and
- Development and evaluation of closure alternatives for mine closure units at the Yerington Mine site.

In order to ensure that data of sufficient quality and quantity are collected to meet the project objectives, the four-step DQO process listed below was utilized to develop the activities described in this Work Plan:

- Step 1. State the Problem;
- Step 2. Identify the Decision;
- Step 3. Identify the Inputs to the Decision; and
- Step 4. Define the Boundaries of the Study.

The problem statement (Step 1) is as follows: "The Wabuska Drain (an agricultural return flow conveyance feature constructed prior to mining operations) may intercept shallow mining-related groundwater and transport constituents of concern via surface water flows and sediment transport to down-gradient receptors. Surface water flows and transported sediment or soils with elevated constituents of concern may pose a risk to human health and the environment. In addition, sediment and soils that may have accumulated within or adjacent to the current alignment of the Drain, or in abandoned portions of the Drain, could also pose a risk to human health and the environment." This problem statement incorporates the information presented in the Conceptual Site Model (CSM) for the

Yerington Mine Site (Brown and Caldwell, 2002d). The flow diagram from the CSM is presented as Figure 5 of this Work Plan.

Step 2 of the DQO process (Identify the Decision) asks the key question that this Work Plan is attempting to address: "What monitoring, sampling and analytical activities for locations along the Wabuska Drain will serve to evaluate the potential risk to the environment and human health, and support the development and evaluation of closure activities at the Yerington Mine site?" The field monitoring and sample collection and analysis activities proposed in this Work Plan will be compared to previous investigations (AHA, 1983 and NDEP, 1999) and will provide the basis for potential future investigations to answer this question. The criteria necessary to determine if the proposed Work Plan activities will answer this question include:

- Will the collected data adequately document the fate and transport of constituents of concern in Wabuska Drain surface water flows, and in transported soils or sediments, to down-gradient receptors; and
- Will the collected data support the development and evaluation of site closure activities for the mine site.

Step 3 of the DQO process (Identify the Inputs to the Decision) identifies the kind of information that is needed to address the question posed under Step 2. Relevant historical and anecdotal information includes knowledge of Drain construction, operations and maintenance, past Drain alignments, previous field monitoring and analytical results, and down-gradient receptors. Some of this information is discussed and evaluated in this Work Plan, and additional historical information will be collected if possible. The information to be obtained from the proposed field monitoring and sample collection and analytical activities will provide an adequate basis to begin to satisfy these criteria. The propose field monitoring, sample collection and analytical activities consist of the following:

- Collection of flow measurements and field parameters from flowing surface water in the Wabuska Drain; and
- Collection of surface water quality samples from flowing surface water in the Wabuska Drain; and

- Collection of solid media samples from soils/sediments in the Wabuska Drain, including abandoned portions of the Drain.

Theses activities are described in detail in Section 3.3.

Step 4 of the DQO process (Define the Boundaries of the Study) defines the spatial and temporal aspects of the field monitoring, sampling and analytical activities proposed in this Work Plan. The sample locations selected by the YTWG representatives for proposed monitoring are shown on Figure 3 (most of which were considered to be potential depositional areas in the field by YTWG representatives). The field and analytical activities described in this Work Plan are anticipated to be conducted when flowing surface water in the Drain is observed adjacent to the mine site (i.e., at sampling locations 1 or 2 shown in Figure 3).

SECTION 2.0
HISTORICAL ALIGNMENT

As described above, the Wabuska Drain was designed and constructed as a low-gradient trapezoidal conveyance with dimensions that become larger in the down-gradient direction as the drainage area increases and subsidiary drains join the Drain along its length. It was constructed to collect and convey excess water associated with irrigation activities and seasonal groundwater level fluctuations. Operations and maintenance of the Drain are controlled by the WRID, although the Drain crosses private lands (permission to access proposed sample locations may be required by private land owners). According to the WRID, the Drain requires minimal maintenance, which typically includes the clearing of brush and routine culvert maintenance (Ken Spooner, WRID; pers. comm. 2002). During development of this Work Plan, Brown and Caldwell did not find evidence of sediment accumulation along the Drain's alignment, including proposed sample locations.

The alignment of the Wabuska Drain has shifted slightly over time in the area immediately north of the Yerington Mine, as seen in the aerial photos and topographic maps from 1938 to the present time (Appendix C). These maps and photos are produced at two scales, 1:30,000 and 1:12,000, to show details in the area north of the mine and to shows its alignment to the north including and beyond the Paiute Indian Reservation. Insets for specific maps and aerial photos are provided at 1:12,000 for direct comparison with other aerial photographs.

Also included is a 1915 topographic map to illustrate that a portion of the Drain appears to have been built on, or in close proximity to, the former Nevada Copper Belt Railway. This is also shown on the 1957 topographic map.

As depicted in the maps and photos presented in Appendix C and described below, all mapped changes in Drain alignment and extent have occurred in the area immediately north of the mine site. No apparent modifications to the Drain have occurred north of the irrigated fields approximately 4,200 feet north of Luzier Lane.

1938 Aerial Photo (C1)

This photo mosaic is the earliest evidence of the approximate position of the Wabuska Drain, which appears as a dark line with white lines running parallel on both sides. The dark line is the drain, while the white lines are channel banks or possibly access roads. The beginning of the Drain is located approximately where the lower label line touches the Drain, and can be delineated from a road or railroad alignment located to the west. This road, or railroad, which appears in the photo from the south and runs through the middle of the illustration, follows the former Nevada Copper Belt Rail Line.

1954 Aerial Photo (C2)

The Drain is discernable in the photo as a dark line with a white line next to it, and is slightly offset from the road or railroad alignment located to the west (identified in the 1938 aerial photo). There appears to be no change in alignment of the Drain from 1938 to 1954 in the area covered by the two aerial photo groups. However, the 1954 aerial photos do not provide as much coverage as the 1938 series. Note the road that outlines the tailings disposal area and other mine site features for reference.

1957 USGS Wabuska, NV Topographic Map (C3)

This topographic map is the first available evidence of the Drain alignment some miles to the north of the Yerington Mine site. The Drain begins approximately 1,800 feet north of the “Tailings Pond.” From there, it continues north and crosses the Campbell Ditch approximately two miles north of the mine. The position of the Old Railroad Grade on this map is similar to that shown on the previous aerial photos (C1 and C2). The East and West arms of the Campbell Ditch are identified on the map along with other unnamed conveyance features. There appears to be no change from the 1938 and 1954 Drain alignment to the 1957 alignment for the area covered by both the photos and the map.

1977 Aerial Photo (C4)

The 1977 aerial photo mosaic provides a color illustration of the mine prior to close of operations the following year. The Wabuska Drain is defined by its dark color bounded by white roadways on either side. The southern terminus of the Drain remains in the same general position to the northeast of the northern-most evaporation pond (labeled in C3 as the "Tailings Pond"). A number of conveyance features located north of the mine are dark-colored and are characterized by vegetation-lined banks. Ditches located immediately north of the sulfide tailings pond appear to have been constructed to contain tailings fluids up-gradient of the irrigated fields, which appear to have separate conveyance features (labeled as Conveyance Features in the photographs presented as C4 and C5).

<u>1980 Infrared Aerial Photo (C5)</u>

The 1980 infrared aerial photo mosaic illustrates the Drain as a dark red/amber color indicative of vegetation within and adjacent to the Drain. The Drain alignment and other conveyance features north of the mine do not appear to have changed from 1977.

<u>1987 USGS Mason Butte, NV Topographic Map (C6)</u>

The 1987 map is the first evidence of a change in Drain alignment, and depicts the Drain beginning southeast of its former location, in the area of the "other conveyance features" shown in C4 and C5. The Drain begins north of the sulfide tailings labeled on the map as "Tailings Pond" and parallels its northern margin to a northwest alignment parallel to a road. The Drain alignment changes as it approaches Luzier Lane, where the Drain jogs back to the east and then heads north for approximately 3,000 feet before heading west and back to the northeast to its original alignment. C8 illustrates these alignment changes. This Map presents the Drain alignment that existed during the 1983 AHA monitoring program.

<u>2001 Color Air Photo (C7)</u>

In this aerial photo, the Drain begins in a similar position shown in C6, north of the sulfide tailings. It parallels the tailings for less than a half-mile before turning northwest and then due north. This portion of the alignment differs from that shown in C6, without the east-north-west jog that is apparent in C6. The remainder of the Drain alignment appears to correspond to historical alignments. Note that most of the other conveyance features that appeared in previous aerial photos no longer exist.

<u>Historical Wabuska Drain and Other Conveyance Alignments (C8)</u>

The alignment of the Drain and other conveyance features were digitized from the aerial photos and topographic maps and combined on the 2001 aerial photo base to illustrate the alignment changes over time. The two major changes in the Wabuska Drain alignment occurred in the time periods between 1980 and 1987 and 1987 and 2001.

SECTION 3.0

WORK PLAN

Atlantic Richfield proposes to conduct surface water field monitoring and sample collection activities at the eight locations along the Wabuska Drain shown in Figure 3 (Location 2 is located in an abandoned portion of the Drain – see Photo no. 3 in Appendix B). Based on the results presented in Section 1.3 for the February 2003 sampling event, additional sampling of soils or sediments at the eight locations shown in Figure 3 is not necessary in the context of developing closure alternatives for the Yerington Mine site.

3.1 Monitoring Locations

Eight proposed monitoring locations for the collection of flow measurements, field parameters and surface water quality samples within the Drain are shown in Figure 3. These locations will allow data collected as part of this Work Plan to be evaluated in the context of the 1999 data collected by NDEP. All monitoring locations will be field-located using a combination of global positioning system (GPS) measurements and mapping using known cultural and topographic features.

3.2 Quality Assurance and Quality Control

Procedures for data collection and analysis will follow the specifications and procedures described in Section 3.3, pursuant to the Draft Final QAPP. These procedures will ensure that the type, quantity, and quality of data collected are reliable with regard to providing information needed to satisfy the DQOs listed in Section 1.4. Data collected from previous and proposed field and laboratory activities will be used to:

- Evaluate the chemical and physical characteristics of water flowing in the Wabuska Drain;
- Determine chemical and physical changes in water flowing in the Drain, relative to locations along its length; and
- Provide information essential for assessing the presence of, and concentrations of, constituents of concern in soil and water

The data collection and analysis procedures will adhere to quality assurance/quality control (QA/QC) methods to ensure that the quality and quantity of the analytical data obtained during the field activities are sufficient to support the DQOs. QA/QC issues include:

- Detection limit and laboratory analytical level requirements;
- Selection of appropriate levels of precision, accuracy, representiveness, completeness, and comparability for the data and any specific sample handling issues; and
- Identification of confidence levels for the collected data.

Section 3.3 describes field measurements and laboratory analytical measurements that will be conducted as part of this Work Plan.

3.3 Data Collection and Analysis Procedures

Field data collection, field measurements, and laboratory analysis procedures described in this Work Plan will be conducted in accordance with the Yerington Mine QAPP. Section 2.4 of the QAPP provides standard operating procedures for surface water field parameter measurements, sample collection, and decontamination.

<u>Field Measurements</u>

Measurements in the field will consist of flow rates of surface water in the Drain, physical channel dimensions and distances, and physical parameters for water including temperature, pH, dissolved oxygen, and conductivity. Field information will be recorded in a field notebook. For each sampling event, the information described in the Documentation section provided below will be recorded.

The pH probe/meter will be calibrated with a three-point buffer solution procedure (4.0, 7.0, and 10.0), in accordance with the manufacturers calibration instructions. The conductivity probe/meter will be calibrated with a standardized solution appropriate for the range of actual field measurements, in accordance with the manufacturers calibration instructions. Dissolved oxygen meters will be checked for accuracy by comparing the measurement of distilled water that has been setting for at least 24 hours at the sample location (ambient-saturated oxygen condition) and elevation (above mean sea level) to a published reference chart that provides standard values for oxygen-saturated water at elevation (or pressure) and temperature. Such charts may be included with the instrument, or are available from published sources such as Standard Methods for Examination of Water and Wastewater.

Instruments that measure temperature will be checked against a separate temperature device such as a standard laboratory-grade thermometer. Re-calibration of a particular field instrument will be conducted whenever the measured value of the calibration standard is +/- 5 percent of the actual value of the standard being measured (EPA Method 25E). Prior to sampling, the pH, dissolved oxygen and electrical conductivity probe(s) will be calibrated per the Draft Final QAPP. After field measurements are completed, a drift check will be performed with each instrument, using the same standard solutions used to calibrate. The purpose of the drift check is to assess the loss of accuracy that often occurs when measurements are performed at different locations.

Field parameters will be measured after each water sample is collected, to avoid possible contamination at the sample location due to disturbed sediment. Measurements of stream pH, temperature, dissolved oxygen, and electrical conductivity will be collected from two to three inches below the water surface. Care will be taken to avoid disturbance of the Drain sediment or soil along the bank that could roll down into the water. Measurements will be conducted by placing the probe directly under the water surface, allowing the value to stabilize, and recording the value.

For stream velocities greater than 0.3 feet per second, a digital flow meter will be used to measure velocity and calculate flow, in accordance with the manufacturers' instructions. For flows less than 0.3 feet per second or where the Drain geometry allows, a cutthroat flume will be used to measure flow. The flume conveys a flow up to about 2.3 cubic feet per second (CFS) without overtopping. The flume will be temporarily placed in the conveyance, leveled and allowed to equalize flow between the inlet and outlet prior to recording the stage in the flume. The flume has a staff gage installed which is scaled in

0.01-foot increments. The recorded stage is converted to flow rates using the manufacturer's rating table.

In general, the 6/10 method will be used for measuring flow rate (Geology Labs, 2000), whereby the velocity measurement at 6/10 of the total vertical depth of the channel from the channel surface is used to measure velocity. This method applies to flow depths up to 2.5 feet deep. In deeper water the 2/10 and 8/10 method may be applied, whereby two measurements at each depth are used to obtain an average channel velocity.

At the specified channel cross section the top width of the flowing channel will be measured then divided into equal increments for determining incremental channel width, depth and velocity. The mid-point method will be used for determining average channel velocity. The product of the width and depth provides the area for each section and the current meter yields the velocity for the section. The sum of the increments equals the total flow.

The physical measurements will be recorded to the accuracy allowed by the measurement method and equipment, with particular attention being given to proper calibration of instruments. Instrument accuracy limits will be specified in the results section of the Data Summary Report.

Surface Water Sample Collection

Samples at each monitoring location will be collected prior to recording field parameters or measuring flow. Samples should be collected from the furthest downstream location first, working upstream to the next locations (i.e., from location 8 to location 1). High-density polyethylene (HDPE) bottles, supplied the analytical laboratory, will be used to collect samples. Prior to collecting the actual lab sample, the collection bottle will be marked with a collection sequence number, and triple-rinsed with the water source being sampled. The water samples will be collected slightly "upstream" of where the bottles are rinsed, to prevent disturbed sediment from contaminating the sample. Water samples will be collected from just below the water surface, taking care to avoid sampling where surface debris is present. Care will also be taken to prevent disturbance of the bed sediment or soil along the bank that could roll down into the Drain. Latex gloves will be used to handle bottles and equipment throughout each sampling event. The gloves will be changed between each sample location.

Both total metals (unfiltered) and, dissolved metals (filtered) samples will be each collected in 500-milliliter (mL) bottles. Non-metals samples will be collected in 1,000-mL bottles, unfiltered, with no acid preservation. Sample bottles for the blank will not be triple-rinsed prior to being filled, so that any contamination from bottles alone would be detected.

The following is a brief summary checklist for water sampling, based on the sampling protocol outlined above:

1. Locate accessible portions of the Drain where access and sampling activities create minimal disturbance to the water that will be sampled. Flowing water is required for sampling. Therefore, proposed sample locations with stagnant water will not be sampled, and the most immediate down-gradient location where flowing water in the Drain is observed will be sampled.
2. Wear a new pair of latex gloves prior to each sampling location. Place indelible identifying mark or label on the containers. Fill a one-liter HDPE container directly by carefully submerging a portion of the mouth of the container into the flow, with the body of the container and hand downstream of bottle mouth. Adjust the container position as needed to obtain a nearly full container (a small head-space may remain).
3. Thoroughly rinse container, dumping out downstream of where sample will be collected. Repeat two more times. Fill the one-liter container with sample water.
4. Unfiltered Samples: Collect the sample in the manner described in 1-3 above, fill the labeled unfiltered sample container, rinse the cap in sample water, seal the container, and wipe off the outside with a clean paper towel.
5. Filtered Samples: Collect the sample in the manner described in 1-3 above, and using an air vacuum pump and one-time use gravity filter with a new 0.45 micron filter, carefully filter the water from the full bottle into the empty one. Perform this activity away from the Drain, taking care not to allow unfiltered water present on surface exteriors to enter the filtered water bottle. Use a fresh pair of gloves for the filtering procedure. Replace the cap, seal the container, and wipe off the outside with a clean paper towel.
6. Measure and record flow, pH, conductivity, and temperature.
7. Preserve all samples as appropriate, compete documentation, package and ship or transport samples.

Decontamination

For surface water sampling, all equipment will be disposable or one-time use with the exception of the hand vacuum pump, which should not normally come in contact with water. Decontamination of the pump between sample locations will occur in the same manner as soil sampling equipment decontamination described below, using decontamination water dedicated for the pump. If the hand pump does come in contact with sample water, the pump should be decontaminated as described below. Although decontamination is not anticipated for surface water sampling, any reusable sampling equipment that may become necessary to use which requires decontamination will be decontaminated as described below.

Clean buckets or tubs (5 gallon buckets are most common) should be used. Buckets should be placed on plastic sheeting to prevent spillage to the ground, and to help keep the decontamination area and equipment as clean as possible. The buckets should be filled half to three-quarters full as follows:

Bucket 1: Tap water with non-phosphate detergent such as Liqui-Nox
Bucket 2: Clean tap water or de-ionized water.
Bucket 3: Clean tap water or de-ionized water.

After the decontamination area is set up, equipment decontamination of sampling equipment is comprised of four general steps:

1. Removal of gross (visible) contamination

   (Gross contamination generally applies to soil sampling equipment, which may have significant residue clinging to the piece of equipment. This can be removed by drybrushing or scraping or water rinse.)

2. Removal of residual contamination

   All reusable sampling equipment used at the site must be cleaned prior to any sampling effort, after each sample is collected, and after the sampling effort is accomplished. Removal of residual contamination consists of the following steps:

   a. Place the item in the first bucket (detergent wash) and scrub the entire surface area of each piece of equipment to be decontaminated. Utilize scrub brushes to remove all visible contamination. Change the water periodically to minimize the amount of residue carried over into the second rinse.

b. Place the item in the second bucket (clear water rinse – tap or deionized water) and rinse. Change the water periodically to minimize the amount of residue carried over into the third rinse.

c. Place the item in the third bucket (deionized or distilled water) and repeat the rinsing procedure. Change water as necessary.

d Place the item on a clean surface such as plastic sheeting to await reuse or packaging for storage (e.g., wrapping foil).

3. Prevention of recontamination

After the decontamination process, equipment should be stored to preserve its clean state to the extent practical. The method will vary by the nature of the equipment. Protection measures include covering or wrapping in plastic or sealable plastic bags, or wrapping with oil-free aluminum foil.

4. Disposal of wastes associated with the decontamination

All washing and rinsing solutions are considered investigation derived waste and should be containerized. After use, gloves and other disposable PPE should also be containerized and handled as investigation derived waste.

Sample Identification and Preservation

Sample labels will be completed and attached to each laboratory sample container after each sample is collected, to avoid saturation of the labels during water collection. Strict attention will be given to ensure that each sample label corresponds to the collection sequence number marked on the bottle prior to sample collection. The labels will be filled out with a permanent marker and will include the following information:

- Sample identification
- Sample date
- Sample time
- Sample preparation and preservative
- Analyses to be performed
- Sample type
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample will be collected. This field identification number consisted of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

For example, the sample collected during the third sampling event at the fourth location sampled will be labeled: 003WD004. Blanks and duplicate samples will be labeled in the same fashion, with no indication of their contents. For example, the duplicate sample to the one stated above might be labeled: 003WD006.

The following sample preservation methods will be followed for collected water samples:

> Total Metals: Add nitric acid to a pH less than 2 after sample collection. Check the pH by pouring a small amount of sample into the bottle cap and checking the pH with pH paper. Discard the liquid in the cap after checking the pH. Cool the sample to 4°C with ice immediately after sample collection.

> Dissolved Metals: If filtered samples are required, filter sample through a 0.45 micron filter using an inline filter immediately after sample collection. Following filtration, add nitric acid to a pH less than 2 after sample collection. Check the pH by pouring a small amount of sample into the bottle cap and checking the pH with pH paper. Discard the liquid in the cap after checking the pH. Cool the sample to 4°C with ice immediately after sample collection.

Sample Handling and Transport

The QA objectives for the sample-handling portion of the field activities are to verify that decontamination, packaging and shipping are not introducing variables into the sampling chain which could render the validity of the samples questionable. In order to fulfill these QA objectives, blank and duplicate QC samples will be used as described below. If the analysis of any QC samples indicates that variables are being introduced into the sampling chain, then the samples shipped with the questionable QC sample will be evaluated for the possibility of contamination.

The following sample packaging and shipment procedures will be followed for the surface water samples to ensure that samples are intact when they arrive at the designated laboratory:

1. Place a custody seal over each container, and place each container in double zip-loc plastic bags and seal the plastic bags shut.
2. Place the protected containers in the appropriate ice chest.
3. If required, fill empty spaces in the ice chest with either pelaspan (styrofoam popcorn) or bubble-pack wrap to minimize movement of the samples during shipment. Contained ice will be double bagged in the same manner as samples.
4. Enclose the chain of custody form and other sample paperwork in the ice chest by placing it in a plastic bag and taping the bag to the inside of the ice chest lid.
5. Seal the ice chest shut with strapping tape and place two custody seals on the front of the cooler so that the custody seals extend from the lid to the main body of the ice chest. Place clear tape over each custody seal on the outside of the ice chest.
6. Label ice chest with "Fragile" and "This End Up" labels. Include a label on each cooler with the laboratory address and the return address.
7. Transport ice chests to the appropriate laboratory within 24 hours by hand-delivery or via express overnight delivery.

Duplicate samples will be collected at a frequency of one in ten samples for each matrix and analysis. Duplicate samples will be collected by filling the bottles for each analysis at the same time the original sample is collected. Each sample from a duplicate set will have a unique sample number labeled in accordance with the identification protocol, and the duplicates will be sent "blind" to the lab. For quality assurance purpose, no special labeling indication of the duplicate will be provided.

A field sample will be designated as the "lab QC sample" at a frequency of 1 per 20 samples (including blanks and duplicates) for all parameters. The lab QC sample is the sample the laboratory will use for its internal quality control analyses. The lab QC sample for water analyses will be a double volume sample. The lab QC sample will be a sample that is representative of other contaminated samples. The sample containers and paperwork will be clearly labeled "Lab QC Sample".

A blank sample will be collected by pouring the blank water directly into the sample bottles at one of the sample locations. De-ionized water will be used for collecting blank water samples. For quality assurance purpose, field blanks will be labeled in the same manner as other samples and will be sent "blind" to the lab, with no special indication of the nature of the sample.

Collected water samples will be labeled, logged on a chain-of-custody form, sealed in zip-loc© bags, and placed in a cooler with ice. Cooler ice will be contained in double zip-loc© bags to avoid leakage during shipment or transport. All samples will be kept secure in the custody of the sampler until they are transferred to the laboratory. Chain-of-custody protocol will be followed throughout the transport process. Each chain-of-custody will contain the following information:

- Project name
- Sampler's name and signature
- Sample identification
- Date and time of sample collection
- Sample matrix
- Number and volume of sample containers
- Analyses requested
- Filtration completed or required
- Method of shipment

Laboratory Analyses

Laboratory analyses for surface water samples collected from the Wabuska Drain will be conducted in accordance with Table 6 .

Criteria that are qualitative and quantitative indictors of laboratory data quality are precision, accuracy, representiveness, completeness, and comparability, and are described below:

- Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions (usually expressed in terms of the relative percent difference or standard deviation).
- Accuracy is the degree of agreement of a measurement with an accepted reference or true value. Usually expressed in terms of percent recovery.
- Representiveness refers to a sample or group of samples that reflects the characteristics of the media at the sampling point. It also includes how well the sampling point represents the actual parameter variations that are under study.
- Completeness describes the amount of valid data obtained from a series of measurements relative to the amount that anticipated to meet Work Plan goals.
- Comparability expresses the confidence with which one data set can be compared to another. Data comparability can be ensured by reporting each data type in consistent units (e.g., all field measurements will be reported in consistent units and analytical methods will be similar or equivalent for all rounds of sampling). Comparability and representiveness are also ensured by the use of established field and laboratory procedures and their consistent application.

Water samples will be analyzed for dissolved metals, total metals, sulfate, nitrate, chloride, acidity, alkalinity, hardness, and total dissolved solids. A state-certified laboratory will perform laboratory analyses.

Documentation

Summary of field measurement and sampling activities will be recorded in a bound site logbook, and entries must contain accurate and inclusive documentation of project activities in objective and factual language. Entries will be made using permanent waterproof ink, and erasures are not permitted. Errors will be single-lined out, should not be obscured, and initialed and dated. The person making the entries will sign at the beginning and the end of the day's entries, and a new page will be started for each day.

The following entries will be made to the bound site logbook and/or filed log sheets:

- General descriptions of weather conditions
- Location of each sampling point
- Data and time of sample collection (field log sheets.)
- The type of blank collected and the method of collection
- Field measurements made, including the date and time of measurements
- Calibration of field instruments
- Reference to photographs taken
- Date and time of equipment decontamination
- Field observations and descriptions of problems encountered
- Duplicate sample location

Photographs will be taken at each field measurement/sampling point. The photo location and number will be recorded on the field log sheets.

3.4 Site Job Safety Analysis

A site-specific Job Safety Analysis (JSA) will be prepared on the basis of the Yerington Mine Site Health and Safety Plan (SHSP). The SHSP identifies, evaluates, and prescribes control measures for safety and health hazards, in addition to providing for emergency response at the Yerington Mine site. SHSP implementation and compliance will be the responsibility of the contractor, with Atlantic Richfield taking an oversight and compliance assurance role. Any changes or updates will be the responsibility of the contractor with review by Atlantic Richfield Safety Representative Lorri Birkenbuel. Three copies of this plan will be maintained. One copy will be located at the site, one copy will be located in Atlantic Richfield's Anaconda office, and one copy will be located in the contractor's office. The SHSP includes:

- Safety and health risk or hazard analysis;
- Employee training records;
- Personal protective equipment (PPE);
- Medical surveillance;
- Site control measures (including dust control);

- Decontamination procedures;
- Emergency response; and
- Spill containment program.

The SHSP includes a section for site characterization and analysis that will identify specific site hazards and aid in determining appropriate control procedures. Required information for site characterization and analysis includes:

- Description of the response activity or job tasks to be performed;
- Duration of the planned employee activity;
- Site topography and accessibility by air and roads;
- Safety and health hazards;
- Hazardous substance dispersion pathways; and
- Emergency response capabilities.

All contractors will receive applicable training, as outlined in 29CFR 1910.120(e) and as stated in the SHSP. Copies of Training Certificates for all site personnel will be attached to the SHSP. Personnel will initially review the JSA forms at a pre-entry briefing. Site-specific training will be covered at the briefing, with an initial site tour and review of site conditions and hazards. Records of pre-entry briefings will be attached to the SHSP.

Elements to be covered in site-specific training include: persons responsible for site-safety, site-specific safety and health hazards, use of PPE, work practices, engineering controls, major tasks, decontamination procedures and emergency response. Other required training, depending on the particular activity or level or involvement, may include MSHA 40-hour training and annual 8-hour refresher courses. Other training may include, but is not limited to, competent person training for excavations and confined space. Copies of site personnel MSHA certificates will be attached to the SHSP.

The individual JSA for the Wabuska Drain work incorporates individual tasks, the potential hazards or concerns associated with each task, and the proper clothing, equipment, and work approach for each task. The following table outlines the tasks and associated potential hazards that are included in the Wabuska Drain JSA:

Sequence Of Basic Job Steps	Potential Hazards
1. Prepare sample bottles and dress in appropriate PPE.	• Burn or corrosion from acid spillage, if sample bottles do not have acid already in them.
2. Collect water sample and decontamination of equipment.	• Skin irritation from dermal or eye contact • Slipping or falling into Drain.
3. All Activities	• Slips, Trips, and Falls
4. All Activities	• Back, hand, or foot injuries during manual handling of materials.
5. All Activities	• Heat exhaustion or stroke.
6. All Activities	• Hypothermia or frostbite.
7. Unsafe conditions.	• All potential hazards.

A copy of the Wabuska Drain JSA is provided in Appendix D.

SECTION 4.0

REFERENCES CITED

Applied Hydrology Associates, May 1983, *Evaluation of Water Quality and Solids Leaching Data*, prepared for Anaconda Minerals Company.

Applied Hydrology Associates, March 2002, *2001 Annual Monitoring and Operation Summary*, prepared for Atlantic Richfield Company.

Brown and Caldwell, 2002a, *Yerington Mine Si4te Closure Scope of Work*, prepared for Atlantic Richfield Company.

Brown and Caldwell, 2002b, Draft Final Quality Assurance Project Plan, prepared for Atlantic Richfield Company.

Brown and Caldwell, 2002c, Site Health and Safety Plan for the Yerington Mine Site, prepared for Atlantic Richfield Company.

Brown and Caldwell, 2002d, Conceptual Site Model for the Yerington Mine Site, prepared for Atlantic Richfield Company.

Brown and Caldwell, 2003, Draft Final Groundwater Conditions Work Plan, prepared for Atlantic Richfield Company.

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Huxel, C.J., Jr., 1969, *Water Resources and Development in Mason Valley, Lyon and Mineral Counties, Nevada, 1948-1965*, Nevada Division of Water Resources Water Resources Bulletin No. 38, prepared in cooperation with the U.S. Geological Survey.

Nevada Division of Environmental Protection – Bureau of Corrective Actions, November 1999a, *Field Sample Plan*, prepared in for the U.S. Environmental protection Agency, Region IX, Superfund Division.

Nevada Division of Environmental Protection – Bureau of Corrective Actions, November 1999b, *Field Notes for Wabuska Drain Sampling*.

Thodal, C.E., and Tuttle, P.E., 1996, *Field Screening of Water Quality, Bottom Sediment, and Biota Associated with Irrigation Drainage In and Near Walker River Indian Reservation, Nevada, 1995-95, prepared by the U.S. Geological Survey, Water Resources Investigations Report 96-4214.*

sampling. Comments on the workplan and follow-up sampling are provided under the heading, “Comments on Atlantic Richfield’s draft Wabuska Drain Workplan” below. Please revise the workplan in accordance with the MOU schedule.

Response to Comment no. 2: Given the need to have the YTWG meet to select monitoring locations, and the acquire to receive written approval to access private property along the Drain, the field sampling described in the attached Draft Final Work Plan was not able to be conducted until February 2003. NDEP and the other regulatory agencies were involved in this decision to defer monitoring along the Drain until these precursor activities were finalized. Please see attached Draft Final Work Plan for the locations of the eight monitoring sites selected by the YTWG, including locations where samples were collected at depth for analyses.

<u>Comments for the Short-term Action Sampling</u>

Comment no. 1: Section 3.1 and Figure 2, Sampling Locations. The low gradient and relatively straight pathway of the drain makes the selection of sampling locations difficult. Some of the locations chosen in this work plan should be moved or at least closely evaluated. Pooling areas at curves in the drain are recommended to study possible deposition of metals. Other sampling points should be where the Wabuska drain juts or angles. Specifically, the sampling location at the southern border of the Yerington Paiute Indian Reservation (WSW-009) should be moved to 40 feet before the drain exits the reservation. This relocation is supported by three lines of evidence:

A) This location is within the reach of the drain which directly connects to the Perazzo Slough.

B) According to the information in Section 1.2 of this Work Plan, this location coincides with the greatest loss of gradient along the course of the drain.

C) One of the few bends in the drain occurs there.

The sampling location where the drain crosses under Highway 95A (WSW-010) is only adequate if a culvert at this point causes sediment accumulation. Otherwise, we suggest moving this sample a short distance to the west to the point where the drain makes what appears to be the most acute bend along its entire length.

Response to Comment no. 1: Please see response to Introductory Comment no. 2, above, and the attached Draft Final Work Plan.

Comment no. 2: Composite sediment samples should be collected and analyzed from the four sampling locations as proposed in the workplan.

Response to Comment no. 2: Please see response to Introductory Comment no. 2, above. As described in the attached Draft Final Wabuska Drain Work Plan, NDEP/Atlantic Richfield collected near-surface (0-6 inches) composite samples from eight locations along the Drain agreed to by the TYWG. In addition, discrete samples at depth (12 and 24 inches) were collected at three of the eight locations.

General Comments on Atlantic Richfield's Draft Wabuska Drain Workplan

Comment no. 1: The scope of an expanded characterization will require sampling over a period of time to capture different flow events, as well as sampling at different locations to determine if certain reaches of the drain are more heavily contaminated than others. Later sampling should also assess possible impacts to the Walker River. The draft plan also lacks adequate information on methods of data interpretation. Also, more discrete sampling in depositional areas is necessary as part of the subsequent sampling effort following revision of the workplan. The draft plan also should provide adequate information on methods of data interpretation.

Response to Comment no. 1: Atlantic Richfield believes that the soil/sediment data collected from the Wabuska Drain in February 2003 will not change in character because no solid materials from the mine site will enter the Drain prior to site closure. The eight monitoring locations selected by the YTWG were determined to be sufficient to satisfy the DQOs stated in the attached draft Final Work Plan, and additional monitoring locations will not be necessary. It is not anticipated that additional solids sampling from the eight monitoring locations selected by the YTWG will be conducted, since these locations included potential depositional areas (as selected by the YTWG). Data interpretation will be presented in the Data Summary Report for the Wabuska Drain Work Plan.

Atlantic Richfield proposes to conduct surface water monitoring at the eight locations described in the attached Draft Final Work Plan when flowing surface water is observed in the Drain immediately north of the mine site (i.e., at locations 1 and 3 of Figure 3 of the attached Draft Final Work Plan). Monitoring of surface water in the Drain prior to this occurrence of flowing surface water at locations 1 and 3 will not provide useful data in evaluating the effect of the mine site on surface water flows in the Drain. Pending the results of this future surface water monitoring event, Atlantic Richfield does not anticipate that additional surface water monitoring will be required because the irrigation conditions that will produce flowing surface water in the Drain are anticipated to generally remain the same.

Comment no. 2: Naturally occurring metals concentrations or those concentrations due to agricultural practices should be established for the purpose of assisting in evaluating potential impacts due to past mining practices and to avoid unnecessary conflict in interpreting analytical results from the Wabuska Drain. Sampling of other irrigation return flow ditches in Mason Valley (i.e. East Ditch, West Ditch), is warranted and could be conducted in conjunction with this sampling event.

Response to Comment no. 2: Given the February 2003 soil and surface water sampling results presented in the attached Draft Final Work Plan, Atlantic Richfield is unsure of the benefit provided by sampling of other agricultural drains in the Mason Valley.~~.~~ However, Atlantic Richfield is willing to discuss the value of such sampling with NDEP, and conduct such sampling if determined necessary.

Comment no. 3: The Wabuska Drain is a potential current and historical source to groundwater and groundwater investigations should be proposed to investigate this possible source as part of the Groundwater Conditions Workplan.

Response to Comment no. 3: Atlantic Richfield agrees with this comment, and the Draft Final Groundwater Conditions Work Plan provides for monitoring locations that will assist in the *understanding of surface water flow in the Wabuska Drain and groundwater conditions in the shallow alluvial aquifer north of the mine site.*

Comment no. 4: Potential receptors include human receptors, such as children from the Yerington Paiute reservation, who may have contact with the intermittent flow.

Response to Comment no. 4: Comment noted, and the attached Draft Final Wabuska Drain Work Plan has incorporated this concept with the addition of Figure 5 (Conceptual Site Model Flow Diagram).

<u>Specific Comments on Atlantic Richfield's Draft Wabuska Drain Workplan</u>

Comment no. 1: Section 1.0, Introduction; There is evidence of erosion on the north face of the tailings that may indicate the potential for surface runoff to the Wabuska Drain under severe storm events. The first sentence of the first paragraph should be modified to encompass this possible scenario. The last sentence of the first paragraph should include sediment sampling, not just soils. In the second paragraph, additional USGS studies should be cited. These include the following:

Thodal, C.E., and P.L. Tuttle. 1996. Field screening of water quality, bottom sediment, and biota associated with irrigation drainage in and near Walker River Indian Reservation, Nevada, 1994-95. U.S. Geological Survey Water Resources Investigations Report 96-4214. 39 pp.

Seitz, H.R., A.S. Van Denburgh, and T.J. LaCamera. 1982. Ground-water quality dewngradient from copper-ore milling wastes at Weed Heights, Lyon County, Nevada. U.S. Geological Survey Open-File Report 80-1217. 48 pp.

Appropriate data from these sources should be included in Section 1.3 Previous Monitoring.

Response to Comment no. 1: The attached Draft Final Work Plan has been revised to reflect the potential erosion of tailings materials into the Wabuska Drain and the suggested modification to the last sentence of the first paragraph of Section 1.0. Pertinent information from the 1982 USGS study is provided in the Draft Final Groundwater Conditions Work Plan. Analytical results for surface water sampled by Thodal and Tuttle (1996) are provided in Appendix A of the attached Draft Final Wabuska Drain Work Plan.

Comment no. 2: Section 1.2, Hydrologic Setting; In the Second paragraph, it would be helpful to note that there was also a flood event in June 1983, but unrelated to winter rain on the mountain snow pack. The first sentence of the third paragraph is awkward and confusing. It may be better to keep discussion of diversions and drains separate. The drains may manage more than Walker River water as they also involve groundwater, a portion of which may be pumped from wells, and not directly diverted from the river.

Response to Comment no. 2: Atlantic Richfield is uncertain what value the suggested reference to the 1983 flood event would add to the Work Plan – please provide (non-anecdotal) information as to why this information is relevant. The fourth paragraph under Section 1.2 of the attached Draft Final Work Plan has been revised to avoid the apparent confusion.

Comment no. 3: Section 1.3, Previous Monitoring; The units (i.e., cfs) need to follow the flow rates in the first sentence of the first paragraph on page 5. The first paragraph on page 6 indicates the location of site WSW-011. However, the inset of Figure 2 labels this site as WSW-008, whereas the main body of the figure correctly labels this sampling point. It also should be noted that site WSW-010 is near sample site number 11 in Thodal and Tuttle (1996). The second paragraph on page 6 indicates the constituents that were elevated at WSW-011. This list should also include aluminum, cobalt, copper, and lead. For example, the aluminum concentration was two orders of magnitude higher than that found at the remaining three sites. Total petroleum hydrocarbons at this site were also elevated.

Response to Comment no. 3: The attached Draft Final Work Plan has been revised to reflect most of this comment. Additional data from monitoring and sampling conducted in February 2003 is provided in the attached Draft Final Work Plan.

Comment no. 4: The statement in the second paragraph of page 6 that "…these constituents were not transported down-gradient…" is misleading. Transport could certainly occur under different flow conditions. Please clarify.

Response to Comment no. 4: The attached Draft Final Work Plan clarifies this statement.

Comment no. 5: Information on the 1999 sampling event for pH and specific conductance should be added to Table 1-2 for a more complete evaluation of the data.

Response to Comment no. 5: The attached Draft Final Work Plan incorporates the suggested information in the document text.

Comment no. 6: It should be noted that pH of drain water in 1983 increased markedly between stations 4 and 5. This reach of the drain might be an area where some metals and trace elements may have precipitated out of the water in relation to the change in pH and therefore may warrant additional evaluation of drain sediments and soils piled on the banks of the drain.

Response to Comment no. 6: The attached Draft Final Work Plan has been revised to note this increase observed in 1983. The soil pH and metals data collected in February 2003, and provided in the attached Draft Final Work Plan, do not support the concept suggested by this comment. In other words, locally increased soil pH does not correlate with any increase in soil metals concentrations and soils metals concentrations in this part of the Drain are well within background values provided by Shacklette and Boerngen (1984). Therefore, Atlantic Richfield believes that additional soils monitoring from the Wabuska Drain is not warranted.

Comment no. 7: Section 1.4, Data Quality Objectives;

A) The first two data quality objectives for this work plan are appropriate for a screening risk assessment. Contaminants from the Yerington Mine site could have impacted at least three aquatic habitats through releases to the Wabuska Drain: the drain itself, adjacent aquatic habitat(s) which connect to the drain, and the Walker River. We view this accelerated study as limited to the first two habitats listed above. In order to use the collected data from the drain in a screening risk assessment, we must select the receptors of concern, as this will guide our choice of toxicity benchmarks. This is necessary because the benchmarks determine whether the detection limits in the work plan are adequate.

For the drain and adjacent habitat, the three most likely receptors of concern are aquatic invertebrates, waterfowl which feed on these invertebrates, and wetland plants. We suggest the US EPA freshwater chronic ambient water quality criteria (available at http://oaspub.epa.gov/wqsdatabase/epa.rep_parameter) be used for comparison to the analytical data for water samples, and the most conservative freshwater sediment benchmarks in MacDonald et al. (2000) and the US DOE terrestrial plant toxicity benchmarks (available at http://www.esd.ornl.gov/programs/ecorisk/reports.html) be used for comparison to the sediment/soil data. We include wetland plants among the receptors of concern because the Wabuska Drain intersects and connects with a seasonal wetland (the Perazzo Slough) as it crosses the Yerington Paiute Indian Reservation.

B) Please revise the third DQO. “Development and Evaluation” are general objectives with no specific definition.

C) The report should state how this data will be utilized for decision making and provide detail on the data summary reports. This information is necessary to ensure that the study is evaluated against the original data objectives and that the study met the objectives. If alternatives are to be evaluated in some type of data summary report, at least three alternatives should be evaluated.

Response to Comment no. 7A: The Data Summary Report for the Wabuska Drain will compare water quality data from the Wabuska Drain with the appropriate screening criteria. The attached Draft Final Work Plan includes the soil/sediment data that was collected in February 2003.

Response to Comment no. 7B: Development and evaluation of closure alternatives are true objectives for the data to be collected.

Response to Comment no. 7C: Atlantic Richfield proposes to compare collected data to background values and the appropriate screening criteria in the Data Summary Report, and evaluate closure alternatives and present the proposed closure methods in the Final Permanent Closure Plan.

Comment no. 8: Section 2.0, Historical Alignment; Figure 3 of the 1983 Applied Hydrology Report also should be included.

Response to Comment no. 8: The attached Draft Final Work Plan includes this information.

Comment no. 9: Other Conveyances; as mentioned previously in the SOW discussions, there are other conveyances (drains, ditches, etc.) that have contained waste material and have exited the mine Site. Some of these structures have been connected or appear to have been connected to the Wabuska Drain (Please see attached photos included from the US Fish and Wildlife, 3/29/83). Atlantic Richfield has stated that these structures will be covered under workplans for the specific Site areas. The text is confusing because these are mentioned in the document, but there is no proposed sampling or study of these areas. For example, on page 12, the second sentence states that these structures were constructed to contain tailings fluids. Investigations are required to determine the extent of contamination, as well as to investigate if these are potential source areas for off-site contamination.

Response to Comment no. 9: Such conveyances, where exposed, will be evaluated pursuant to the Draft Final Tailings Areas and Evaporation Ponds Work Plan. Because the attached Draft Final Wabuska Drain Work Plan addresses current physical and chemical conditions in the Drain, the extent of potential effects (e.g., elevated soil metals concentrations) caused by past releases to the Drain has been captured by the February 2003 soils monitoring described in the attached Draft Final Work Plan, and will be captured by proposed surface water monitoring in the Drain to be triggered by the observation of flowing surface water immediately north of the mine site.

Comment no. 10: Section 3.1 and Figure 2, Sampling Locations. The low gradient and relatively straight pathway of the drain makes the selection of sampling locations difficult. Some of the locations chosen in this work plan should be moved or at least closely evaluated. Pooling areas at curves in the drain are recommended to study possible deposition of metals. Other sampling points should be where the Wabuska drain juts or angles. Specifically, the sampling location at the southern border of the Yerington Paiute Indian Reservation (WSW-009) should be moved to the point where the drain exits the reservation. This relocation is supported by three lines of evidence:

A) This location is within the reach of the drain which directly connects to the Perazzo Slough.

B) According to the information in Section 1.2 of this Work Plan, this location coincides with the greatest loss of gradient along the course of the drain.

C) One of the few bends in the drain occurs there.

The sampling location where the drain crosses under Highway 95A (WSW-010) is only adequate if a culvert at this point causes sediment accumulation. Otherwise, we suggest moving this sample a short distance to the west to the point where the drain makes what appears to be the most acute bend along its entire length.

Response to Comment no. 10: Please see response to Introductory Comment no. 2, above.

Comment no. 11: Additionally, soil samples should be collected at the following sampling locations at a minimum of one and two feet depths:

A) Yerington Paiute reservation; at a low point adjacent to the culvert on the seasonal wetland (Please see attached photo with the culvert draining into the wetland; EPA Site visit, 5/22/02).

B) Private land on the downstream side of the Perazzo Slough, west of the Wabuska Drain.

C) There should be several sampling points closer to the Walker River, since deposition has probably occurred and re-occurred several times since the mine closed. Is the Campbell ditch included in this study, or will it be studied under another work plan? Since the same type of sampling equipment should be used while analyses are done on other surface water carrying conveyances, it would appear that it would be prudent to do these studies at this time.

Response to Comment no. 11: As presented in the response to Introductory Comment no. 2 and the attached Draft Final Work Plan, the YTWG agreed to the selection of eight monitoring along the Wabuska Drain (including likely depositional areas) and the collection of composite samples from the depth interval 0-6 inches at each location and discrete samples at 12 and 24 inch depths from three of the eight locations.

Comment no. 12: Sampling procedures; The composite sample analyzed from the surface to six inch depth will be useful to assess current exposure, however, more discrete sampling in depositional areas is necessary. It is very likely that some deposition of metals has occurred, and hopefully is currently capped by sediment. It is possible that these areas should not be dug out, as this could open the area to "new" contamination. It is unclear whether the Irrigation District takes this possibility into account. We would suggest that a search be conducted at areas most likely to have high deposition and a few cores should be completed to refusal. The cores should be done with clear polyethylene pipe, brought out and photographed, if possible. Samples should be eyeballed; along with a sampling plan allowing discrete samples at 1/4 the core intervals if the core is longer than 4'. If Sediment/soil samples are collected at different depths, each depth should be analyzed separately. This type of sampling further down the drain where the material has been possibly deposited and picked up several times should be added to the workplan. The rationale for this sampling is twofold. First, to determine if chemicals of concern increase farther from the Site as stated in the work plan. Second, because of the variability from high to near no flow annually, it is possible that it will be difficult to calculate the deposition rate with any certainty.

Response to Comment no. 12: Please see response to Introductory Comment no. 2, above, the attached Draft Final Work Plan and the response to Comment no. 11. Discrete sampling was conducted at depths of 12 and 24 inches at three of the eight monitoring locations agreed to by the YTWG. Atlantic Richfiled is confident that the quality of the data collected in February 2003 will achieve the DQOs stated in the attached Draft Final Work Plan, specifically the evaluation of closure alternatives and the ability to assess human health or ecological health risk.

Comment no. 13: Quality Assurance;

A) Method 6010B is now available on the EPA web site (search www.epa.gov for SW846, and scroll to the new method for metals in sediments).

B) The QAPP should denote that the trowel should be plastic and not metal; some aluminum trowels may be scraped by small rocks and add aluminum or other metals to the samples.

C) Metals do not have to be iced in the field. There is a possibility of the cold temperatures causing precipitation.

Response to Comment no. 13: This comment has been incorporated in the attached Draft Final Work Plan and the Draft Final QAPP.

Comment no. 14: 3.3 Data Collection and Analysis Procedures; The order in which the sites are to be sampled should be noted, starting with the most down-gradient site and moving sequentially toward the mine to preclude contamination of down-gradient samples from physical sampling activities. All water bottles and glass jars used for collection and/or storage of samples should be certified as clean based on U.S. Environmental Protection Agency standards.

No information was provided as to why sediment/soil samples would be collected from the drain banks instead of from unexposed sites in the bed of the drain channel. The current protocol appears to avoid sites that may be most highly contaminated. Also, how will sample locations along the abandoned portions of the drain be determined? It is a priority to locate and sample the bottom of the old trapezoidal channel.

Response to Comment no. 14: Please see response to Introductory Comment no. 2, above, and the attached Draft Final Work Plan. All samples were collected to avoid contamination of down-gradient samples from physical sampling activities. Sample locations selected by the YTWG were selected, in part, because they appeared to be depositional sites with the greatest potential for impacted soils to occur.

Comment no. 15: Table 3-1 and Table3-2; Beryllium and Uranium should be included.

Response to Comment no. 15: Beryllium was included in the analyte list, as presented in the attached Draft Final Work Plan. Uranium was not included.

Comment no. 16: Accordingly, please provide the **Final Wabuska Drain Work Plan, Yerington Mine Site** which incorporates the above comments. This information must be received not later than July 19, 2002 as per the previously agreed submittal schedule.

Response to Comment no. 16: As discussed in the responses to introductory comments, the submittal date for the attached Draft Final Wabuska Drain Work Plan was delayed due to the monitoring site selection process (as proposed by the YTWG) and the process of receiving approvals for access to private property along the Wabuska Drain to conduct the monitoring and sampling activities.

If you have any questions regarding these responses to comments or the attached Draft Final Wabuska Drain Work Plan, please contact me at 1-406-563-5211 ext. 430.

Sincerely,

Dave McCarthy
Project Manager